## Subject Index

ddison's disease, memory impairment in, Adrenal steroids and brain morphology, 10 and dentate gyrus formation, 77 cell birth effects of, 80-81 cell migration effects of, 82 cell survival effects of, 78-80 direct versus indirect effects of, 82-83 Aging. See also Alzheimer's disease cognitive decline in, 184-186 cholinergic systems and, 166-168 and memory, 214 and neurodegenerative diseases, 184 NGF/NGF-receptors and, 173 vasopressin expression during, 106–107 Alzheimer's disease. See also Aging cholinergic neuron loss and, 166 estradiol-enhanced memory in, 29 estrogen and, 184, 186, 226 in post-menopausal women, 12 ERT and, 227, 233-236 sex differences in, 12 Androgens in motoneuron repair, 141-143, 155-156 gender differences in, 153-155 and vasopressin production, 102-105 Apoptosis, glucocorticoids and, 247-248 Avian neurobiology integration, 31-32 neurogenesis, 30-31 Avian song production adult plasticity in, 28-30 anatomical shifts in, 29-30 day-length cues in, 29 song system neuroanatomy changes and, 28-29 Avian song system auditory song learning, 23 endocrine interactions during, 26 selective neuron activation during, 25 structural changes during, 24 day length and, 29 earliest development, 21-23 HVC in, 20-26, 28-32 learning and, 19-21 motor song learning in adulthood, 27-28 anatomical sex difference changes and, 26 gonadal steroids role in, 27 in plastic phase, 26-27

neuroendocrine interactions and, 19-21

neuron types in, 21

seasonal changes in, 28-29 sexual dimorphism in, 21

Basal forebrain cholinergic systems in, 167 estrogen and, 174-183 and cognition, 167 ERT effects in, 165, 184 Brain. See also Basal forebrain; Hippocampus; Hypothalamus hormone-induced changes in, 45 non-genomic steroid hormone action in, 5 reversible changes in, 45-46 steroid hormone action in, 4-5 vasopressin innervation of, 96-99 sexual dimorphism in, 95-99 steroid-responsivity of, 99-113 Brain structure hormonal effects on, 9-10 sex differences in, 6 developmental determinants of, 6-9

AH. See Congenital adrenal hyperplasia Catamenial epilepsy cyclical nature of, 11 sex hormone levels and, 11-12 ChAT activity cholinergic neuron impairment and, 167 and cognition, 166-167 ERT effects on, 175-178 estrogen effects on, 174-175 ChAT levels ERT and, 175-178 estrogen and, 174-175 Cholinergic neurons and cognitive processes, 167-168 in age-related cognitive decline, 167 and Alzheimer's disease, 166 NGF-responsive, 165 Cholinergic systems and cognition aging and, 166-168 learning/memory functions, 166 ERT and, 165-166 and NGF receptor expression, 179-182 Cognition age-related decline in, 166-168 ChAT activity and, 166-167

cholinergic neuron impairment and, 167 cholinergic systems and, 166

and dementia, 1, 12

ERT and, 183–186 in neurodegenerative disease, ERT and, 184 NGF and, 173 sex differences in, 214–216 Congenial adrenal hyperplasia (CAH), 215 Cushing's syndrome, memory impairment in, 209

ementia ERT for, 12 estrogen reduction of, 1 Dendritic spine density estrogens and, 52-53 fluctuations in, 51-52 gonadal steroids and, 46-51 and lordosis, 52, 54-55 sex differences in, 9 testosterone and, 54-55 Dentate gyrus adrenal steroids and, 77-78 and cell birth, 80-81 and cell migration, 82 and cell survival, 78-80 direct versus indirect effects, 82-83 cell birth-cell death relationship in, 86-88 development of adrenal steroids-excitatory input interactions in, 85-86 excitatory amino acids and, 83-85 formation of, 74 in adulthood, 76-77 in embryonic period, 74-75 in postnatal period, 75-76 Diethylstilbestrol (DES), women exposed to cognitive functions in, 215–216 learning disabilities in, 215-216 Dyscalculia, 215 Dyslexia, 215

Epilepsy. See also Catamenial epilepsy estrogen effect on, 1
ERT. See Estrogen replacement therapy
Estradiol. See also Estrogen double role of, 6
and HVC, 23
spatial memory enhancement by, 207–208
synapse induction by, 7–8
Estrogen. See also Estradiol; Gonadal hormones; Sex hormones;
Testosterone
and cholinergic systems, 174–183
and cognitive function, 183–184, 226

and dendritic spine density, 52-53 effects of on ChAT activity, 174-175 on cognitive function, 184-185 hypothetical mechanism of, 182-183 on memory, 213-227 on NGF cholinergic function, 185 on NGF receptors, 175-179 and epilepsy, 1, 11-12 and female reproductive system aging, 66-69 and hypothalamus development, 61-62 and lordosis, 49, 51, 54-55 and mood, 224-225 morphological alterations induced by, 46 and Parkinson's disease, 1 and post-menopausal dementia, 1 and post-synaptic membrane organization, 62 - 65and synaptic plasticity, 52, 65-66 synaptogenesis regulation by, 61-69 and vasopressin production, 102-105 Estrogen deficiency and Alzheimer's disease, 226-227, 233-236 and osteoporosis, 226 Estrogen replacement therapy (ERT) and age-related cognitive deficits, 184 for Alzheimer's disease, 227, 233-236 and basal forebrain cholinergic function, and ChAT activity, 175-178 and ChAT levels, 178-179, 183-184 and cholinergic systems, 165-166, 174-175 and cognitive function, 184 for dementia, 1, 12 and memory, 183-185, 226-227 and neurodegenerative disease, 184-185 and NGF receptor levels, 178-179, 184 in post-menopausal women, 218-223

Gender differences. See Sex differences
Gene expression, hormonal control of, 5
Glucocorticoids
and apoptosis, 247–248
as immunosuppressive agents, 247
Glucocorticoid therapy
anti-inflammatory mechanism of, 245–247
doses used, 242–243
in neuroprotection, 247–248
pulsed, 244–245
in spinal cord injury, 241–242
time window for, 243–244

Gonadal hormones. See also Estrogen; Sex hormones; Steroid hormones; Testosterone activational effects of, 45-46 and brain damage, 12 and brain development, 45 and brain morphology, 9-10 and dendritic spine density, 46-51 effects of, 95-96 cellular basis of, 102-105 on neurotransmitter activity, 95-96 on nonreproductive behaviors, 165 sex differences in, 96-99 on vasopressin systems, 107-109 in motoneuron regeneration, 143-156 gender differences in, 153-155 and neuronal plasticity, 45-55 as neurotrophic agents, 141-143 and sex differences, 1-3, 45 and vasopressin pathways, 101-102 Gonadal steroids. See Gonadal hormones

ighest vocal center (HVC) in avian song system, 20-21 cell death effects in, 22 cell death rates in, 22 changes during song learning period, 24 and conspecific song discrimination, 30 early development of, 21-22 endocrine neurons in, 21 estradiol and, 23 in males, 24-25 projections to/from, 20, 22 seasonal changes in, 28-29 sexual dimorphism in, 21-22 in song system development, 21-22 Hippocampus. See also Brain restructuring in, 201-203 steroid hormone levels and, 202 sex differences in, 10-11 Hormone action and gene expression, 4-5 mechanism of, 4-5 non-genomic, 5 Hormone effects, on morphology, 9-10 Hormone levels sex differences in, 4 in young adult humans, 2 Hormone metabolism, sex differences in, Hypothalamus. See also Brain

dendritic spine density in estrus and, 49–51

gonadal steroids and, 46-49

and lordosis behavior, 49, 51 ultrastructural observations, 51–53 neuronal plasticity in estrogen and, 46 gonadal steroids and, 45-46

Ischemia degeneration/restructuring following, 129–135 mossy fiber system and, 122–129 and neuronal death, 121 selective vulnerability and, 121–122

Late luteal phase dysphoric disorder (LLPDD), sex hormone levels and, Learning aging and, 166-168 ChAT activity and, 166-167, 173 cholinergic neuron impairment and, 167 cholinergic systems and, 166 estrogen and, 183-185 NGF and, 173 Learning disabilities. See also Dyscalculia; Dyslexia in CAH, 215 in DES-exposed women, 215-216 sex differences in, 12 LLPDD. See Late luteal phase dysphoric disorder Long-term memory (LTM), 213-214 Lordosis dendritic spine density fluctuations and, dendritic spine induction and, 52, 54-55 estrogen and, 49, 51, 54-55 estrogen-induced, 185 serotonin control in, 54 testosterone and, 54-55 Lordosis behavior, 49, 51

Memory. See also Long-term memory; Short-term memory aging and, 166–168, 214, 226 Alzheimer's disease and, 226 estradiol effects in, 209 ChAT activity and, 166–167, 173 cholinergic neuron impairment and, 167 cholinergic systems and, 166 component processes of, 213–214 ERT and, 183–185, 226–227 estradiol-enhancement of, 209

LTM. See Long-term memory

impairment of
in Addison's disease, 209
in Cushing's syndrome, 209
neuron population stability and, 73
in women
estrogen maintenance of, 226
menstrual cycle studies of, 217
Mental disorders, sex differences in, 12
Mossy fibers system, and ischemic cell death,
122–123
mechanism of, 128–129
spiny interneurons in, 123–128
Motor neuron repair
androgens in, 143–144, 155–156
central neural plasticity alterations,
155–156

gender differences in, 153-155 gonadal steroids and, 141-143

testosterone effects on, 143-153

Neurotransmission gonadal steroid effects on, 95–96, 106 vasopressin expression and, 106

Osteoporosis, as estrogenic effects model, 226, 234

Parkinson's disease
estrogen-exacerbated symptoms in, 12
estrogens and, 1
Phenotypic sex characteristics, reversal of,
2–3
Premenstrual tension. See Late luteal phase
dysphoric disorder
p75NGFR. See Nerve growth factor receptors

Nerve growth factor (NGF). See also Cholinergic systems; Neuropeptides and aging, 173 cholinergic function of in cognition, 173 estrogen effects on, 185 Nerve growth factor (NGF) receptors in adult brain, 169-172 and basal forebrain cholinergic neurons, 168-169 cholinergic regulation of, 179-182 ERT and, 175-179 and NGF effects, 172-173 Neurodegenerative diseases, estrogen and, 184-185 Neurogenesis, 30-31 adrenal steroids and, 78-83 in avian neurobiology, 30-31 in dentate gyrus formation, 73-74 in adulthood, 76-77 in embryonic period, 74-75 in postnatal period, 75-76 in mammalian systems, 73 Neuronal death. See also Ischemia degeneration/restructuring following, 129-135 mossy fiber system and, 122-129 selective vulnerability and, 121-122 Neuronal regeneration, 45 Neurons. See also Cholinergic neurons Neuropeptides. See also Nerve growth factor; Neurotransmission; Vasopressin as gatekeepers, 95-96 steroid effects on, 95-96

Regeneration
of motoneurons
androgens and, 141–143, 155–156
testosterone and, 143–153
of peripheral nerves
gender differences in, 153–155
molecular mechanism underlying,
150–153
Ru486, and synapse elimination blockage,

Schizophrenia, 12 Serotonin, and lordosis control, 54 Sex differences in Alzheimer's disease, 12 in avian song system, 21 in brain structure, 6 in cognitive functioning, 214-216 in dendritic spine synapse density, 9 determinants of, 2-3 in vertebrates, 3 developmental determinants of estradiol, 6-7 neonatal sex steroids, 6, 8 testosterone, 6-9 in disease occurrence, 12-13 in gonadal hormone effects, 96-99 gonadal hormones and, 1-3, 45 hippocampus and, 10-11, 13 hormonally determined variations in, 3 in hormone levels, 4 in hormone metabolism, 4-5 in learning disabilities frequency, 12

in peripheral nerve regeneration, 153-155 in psychotropic drug actions, 12-13 in response to sex hormones, 6-9 reversal of, 2-3, 6 in schizophrenia frequency, 12 in serotonergic/dopaminergic function, 11 in stress-related neuronal loss, 12 testosterone metabolism and, 3-4 in vasopressin cell development, 104-105 in vasopressin expression, 100-101 in vasopression innervation, 96-99 Sex hormones. See also Estrogen; Gonadal hormones; Testosterone and LLPDD, 12 and morphological changes cyclical, 9-10 in hippocampus, 10-11 in serotonergic/dopaminergic function, and neural tissue, 1 and neuropeptide gene expression, 5 non-genomic actions of, 5 roles of, 1 Sexual dimorphism. See Sex differences Short-term memory (STM), 213-214 Spatial memory adrenalectomy and, 206-207 estradiol-enhancement of, 207-208 clinical implications of, 208-209 stress-induced impairment of, 204-205 testing of, 203-204 Steroid hormone activational effects on cognitive functioning, 217-218 menstrual cycle and, 216-218 on spatial functioning, 216 Steroid hormones. See also Gonadal hormones and hippocampus restructuring, 201-203 STM. See Short-term memory Stress and hippocampal neuronal loss, 12 and spatial memory impairment, 204-206 Synaptic plasticity, during ovarian cycle, 65-66 Synaptogenesis estradiol and, 10

Testosterone and dendritic spine density, 54–55 and lordosis, 54–55 and phenotypic sex characteristics reversal, 2–3 and sex differences, 2–3, 6–9

estrogen regulation of, 61-69

and vasopressin expression, 100–101 and vasopressin production, 102–105
Testosterone effects
on cranial motoneuron recovery, 146–148 on facial paralysis recovery, 144–146 on peripheral nerve regeneration gender differences in, 153–155 molecular mechanism underlying, 150–153
on spinal motoneuron regeneration, 149–150
Testosterone metabolism, and sex differences, 3–4
TrkA. See Nerve growth factor receptors

V asopressin. See also Neuropeptides as "gatekeeper," 95-96 Vasopressin cell development, sex differences in, 104-105 Vasopressin expression hormone effects on, 99-102 in adulthood, 99-102 during aging, 106-107 cellular basis of, 102-105 functional significance of, 107-109 and neurotransmission, 106 sex differences in, 100-101 sex hormones and, 102-105 steroid-responsive coordination of functions in, 109-112 in humans, 112-113 Vasopressin innervation of brain, 96-97 sexual dimorphism in, 96-99 steroid-responsivity of, 99-100 coordination of functions, 109-112 in humans, 112-113 Vasopressin projections. See Vasopressin innervation

Alzheimer's disease in, 12, 227, 233–236
DES-exposed
cognitive functions in, 215–216
learning disabilities in, 215–216
memory in, estrogenic effects on, 213
post-menopausal
dementia in, 1
estradiol-enhanced memory in, 209
hormone replacement therapy in,
218–223
stress-related disorders and, 12



## Index of Contributors<sup>a</sup>

A1-Shamma, H. A., 95-120

Buzsáki, G., 121–140

Constantini, S., 241-265

De Vries, G. J., 95-120 DeVoogd, T. J., 19-43

Fillit, H., 233–239 Frankfurt, M., 45–60

Gallyas, F., 121–140 Garcia-Segura, L. M., 61–71 Gibbs, R., 17, 42, 60, 92, 93, 163, 165–199, 230, 238 Gould, E., 73–93 Grayson, M., 17

Harding, C., 42–43, 265 Harvey, M., 17, 42, 140, 265 Horvath, Z., 121–140 Hsu, M., 121–140

Jones, K. J., 141–164, 197, 199

Kume-Kick, J., 241–265

Leedom, L., 61–71 Lewis, C., 61–71 Luine, V. N., 60, 93, 140, 162, 198, 201–211, 231

Masakowski, Y., 231 McEwen, B. S., 1–18 Messer, A., 164 Moller, P., 59 Moorjani, B., 17–18, 41, 60, 92, 163, 197, 198, 263, 264

Naftolin, F., 59, 61-71

Panteon, R., 161, 163

Schwartz-Giblin, S., 42, 59, 140 Sherwin, B. B., 213–231, 238 Shupack, C., 140 Sik, A., 121–140 Sterbank, L., 239

Thompson, R., 43

Voustianouk, A., 41, 139

Young, W., 241-265

Zeigler, P., 162 Zhou, L., 95–120

<sup>&</sup>lt;sup>a</sup> Page numbers shown in italics refer to comments made in discussions.